

Interregional Trade: Adjunct to Innovation^{1,2}

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WEALTH FROM TRADE: HISTORICAL PERSPECTIVE

Introduction

Gains from trade are an obvious fact, and the gains in a free exchange benefit both sides of the agreement. Contemporary accounts by the earliest European explorers in the Far North of this continent tell of annual exchanges between the Innuits (Eskimos) of the Arctic Sea littoral with the Indians of the taiga (North Woods), even though Innuits and Indians were mortal enemies and would kill each other on sight. The products of the Arctic (ivory, furs, fish hooks, fish) were of immense benefit to the Indians because they were otherwise unavailable. Reciprocally, the furs of the forest, and products of wood were of immense value to the inhabitants of the tundra, a treeless plain. The exchange would take place without a face to face encounter. One group would leave their goods in a traditional sheltered spot and the other group would subsequently take the goods and leave in their place the bounty of a different region.

In a modern exchange economy with money as a medium of exchange, the gains of trade are equivalent to an increase in real income in both trading regions. When products or their substitutes become available for a lower cost the situation is equivalent to an increase in income.

Marco Polo's fabulous recitation of his adventures with his father and his uncle is an account of a commercial venture to bring luxury goods from the Orient to Venice in exchange for Venetian goods. The silks of China, the spices of South Asia, and the damasks of Persia were carried by camel caravans protected by private armed guards across thousands of miles of desert, steppe, and mountains. The fabled cities of Bokhara and Kashgar, and Samarkand and Khotan, are oases along the route, on alluvial fans watered by mountain rivers descending into an arid land. The caravans were commercial ventures involving substantial capital and entrepreneurial skill deployed for commercial gain. The flow of luxury goods and ideas was in both directions. The woolen textiles from Flanders and the exotic products of Europe found their way to the great court of the Mongol emperor (Kublai Khan) ruling on the peacock throne (Barraclough 1987a).

Commercial Towns and Market Economies

The Middle Ages lasted for 1,000 years, from the fall of Rome to the Renaissance. About the year 1000 runaway serfs and other itinerant merchants appeared at medieval villages and at customary fair locations with goods for sale. These merchants, of low esteem, were the harbingers of change. Slowly their customary trading places outside the walls of a great baron's fortified town became the focus of commercial activity. This external trade was the engine that allowed the townspeople to extract from the feudal baron privileges that ultimately created the middle class of freemen—the townspeople. The alliances of freemen in the commercial towns of western Europe with a remote king caused the severance of fealty to the local lord, and ultimately the establishment of the nation states—a new concept.

Prior to the development of the commercial town in Europe, administrative places with aggregations of population existed. These centers concentrated the officials and functionaries required to administer ecclesiastical lands controlled by abbots and bishops and other ecclesiastical barons. Sometimes the towns were the administrative centers of secular lords, but the commercial towns, usually outside the walled, medieval fortified towns, were new creations, pregnant with the chrysalis of a new social economic system (Pirenne 1937).

The medieval church and their administrative towns were institutions for stability, for status quo. Itinerant merchants and the commercial towns worked for profit and required cash money—not barter—for their goods. The transformation process was slow but inevitable. The ultimate result was a new class of town dwellers no longer bound to the land. A market system with exchange in money rather than by barter slowly gained ascendancy. As a result commercial trade rapidly increased and lifted the real incomes of the emergent nations of the modern world.

Colonial Enclaves and The Plantation System

Prince Henry the Navigator of Portugal financed the cartographic research and the expeditions of discovery that mapped the coast of Africa. By 1498 Vasco de Gama had rounded the Cape of Good Hope and shortly thereafter reached India. The spices of Zanzibar and the Malabar coast of India assured great wealth to the innovating sailors who established commercial enclaves on these far shores. Christopher Columbus was also a product of this graduate education for mariners. The Spanish encounters following Columbus are not in the category of free exchange because the Spanish motive was conquest for tribute, not free trade with the indigenous people. The conquest of Mexico by Cortez replaced the tyranny of the Aztecs with the tyranny of the Spanish. The conquistador system was exploitative to the extreme. The king of Spain

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confirmed feudal title to the conqueror for land brought under subjugation.

The Dutch and English that followed the Spanish conquerors were driven by the same desire for profits but the exploitation took a different form. After the famous voyages of discovery some of the emerging great powers of Europe engaged in peripatetic efforts to plant coastal enclaves on newly discovered shores or on nearby islands off foreign shores. The effort was global, and discoverers and traders unfolded the new world during the sixteenth and seventeenth centuries. A trading system emerged consistent with the new world order. This trading system, compatible with international rivalry for foreign colonies, was based on a monopsonistic principle. The mother country controlled the supply of goods emanating from her colony. Great plantations were established in the colonies to provide efficient production of agricultural products on a large scale for consumption in the mother country or for resale by the great colonial stock companies. The plantations on foreign shores were often manned by imported labor. For this reason East African countries all have large Indian minorities, as do islands of the Pacific, and Sri Lanka in the central highland region where tea is produced (Barracough 1987b).

From a trading perspective the result was an abundance of tropical imports (primarily food and fiber) into the European countries. The tropical products were exchanged for the handicraft products of Europe before the industrial revolution, when the technology advantages of the mother country versus the colonial nations were weighted largely toward military pursuits. In many other aspects of living the foreign regions were hardly inferior to the European regions in scale of living, cultural advancement, and political organization. The plantation system was exploitative in the tropical countries of origin, but the system was also efficient. The price of the commodity produced was often reduced to a small fraction of the pre-plantation price.

The Imperial Trading System

Almost two centuries of commercial growth followed the great discoveries by Vasco de Gama, Christopher Columbus, and Ferdinand Magellan. The naval powers of that time were all engaged in gold and silver trade, slave trade, sugar trade, and trade in other tropical agricultural products. The activities were performed by companies that usually had monopoly charters from the monarch in the European home country. The coastal enclaves and off-shore island trading stations in foreign countries were established in strategic locations and were defended to keep out foreign competitors. By the mid 1600s Amsterdam was the richest city on earth, based on wealth created by trade, especially the spice trade. By the mid 1700s commercial rivalries were a substrate underlying four world wars: 1) Wars of the League of Augsburg, 2) War of the Spanish Succession, 3) War of the Austrian Succession, and 4) Seven Years War. The wars were engaged by the European powers with prizes in far flung regions and distant oceans. The final result was preeminence of Great Britain, the greatest naval power. Although Britannia ruled the waves, other European powers also projected

power to foreign shores. Imperial expansion at the global scale was political policy.

The Napoleonic Wars defined the European boundaries of the naval power rivals and largely ended the internecine wars on the continent of Europe. For most of the nineteenth century the conflicts were within the interior of foreign regions with the inevitable (with some exceptions) domination of the European state. The coastal station or enclave was no longer sufficient. France acquired her Indo-Chinese possessions in southeast Asia and enormous areas in Central Africa. Great Britain acquired the crown jewel, India, South Africa, Rhodesia, Burma, and island chains throughout the Pacific. Under the colonial system entire nations were brought into conformability with industrial society imperatives. The interiors of continents were subjugated in order to extract mass supplies of agricultural and mineral inputs, and to assure mass markets for outputs from the factories at home (Barracough 1987c). The self-centered interests of imperialism raised the level of real incomes in the mother country but also in the colony. Incomes raised in the colonies were typically to a non-democratic colonial elite rather than to a widespread middle class.

The imperial trading system prevailed right up to World War II. Then Germany and Japan belligerently embarked on a militaristic expansionist policy that aroused the civilized world because of the barbarity of their conduct. With the end of the war the end of the imperial system was foreordained. A great wave of colonies became independent nations during the 1950s and 1960s. Rolling back mid-twentieth century German and Japanese imperialism implied the end of the imperial system. The break-up of the USSR leaves China as the last great imperial power.

WEALTH FROM PRODUCTION: THE ROLE OF INNOVATION

The Industrial Revolution

Coincidentally, the industrial revolution began about the same time that England was losing its grip on the thirteen North American colonies. The first wave of the new production system consisted of advances in textile machinery, including spinning and weaving—fundamental innovations that allowed cotton fibers to be twisted to a strength equal to linen. The result was unparalleled demands for cotton. In addition, the steam engine became the focus of an industrial age that utilized available coal to pump water out of the mines that furnished fuel to drive the stationary machinery of the new factory system and to power the locomotives of a new transport system. The destiny of mankind was changed forever. The associated social changes were as fundamental as those associated with the invention of agriculture some 14,000 years earlier, when hunters became farmers.

The early wave of the industrial revolution was characterized by the factory system, with fixed plant sites. Extensive use of fuel for energy to power steam machinery, combined with the concept and practice of interchangeable parts, made possible mass production. Nearly all of the first wave innovations occurred in England and the wealth generated was largely for the

beneficial interest of English capitalists. The great innovations in production that resulted from the systematic application of science quickly caused improvements in the standard of living in the innovating regions.

James Watt patented his improved steam engine in 1766. By 1795 a railroad company using a steam engine locomotive was making regular scheduled stops, and by 1825 steamboats were making round trips along the Hudson. By 1835 a steamboat was operating on the Ohio River using Cincinnati docks. Transportation improvements followed quickly, along with communication improvements, especially the invention and diffusion of the telegraph and telephone.

Continuously falling transport costs and communication costs allowed competitors separated by great distance to compete head to head in regions far removed (Barraclough 1987d). Today fuel and ore are transported for a few pennies per ton-mile. The result has been a bonanza for the consumer: For the consumer a drop in transport cost is equivalent to an increase in real income, providing that the commodity market is a competitive market.

A second burst of science-based innovations were combined with organizational changes, including assembly line techniques and large scale financing arrangements that characterized the late decades of the 1800s and the early decades of the 1900s. In 1905 the 50 year reign of Queen Victoria was celebrated and the British poet laureate could appropriately boast that the sun never sets on the British empire. Nevertheless, the technological advances of the late 1800s and the early 1900s no longer greatly favored Great Britain as compared with the United States and European rivals. Development of dynamos, motors, transformers, electrical power grids, the chemical industry, the pharmaceutical industry, the steel industry, and the internal combustion engine using petroleum based liquid fuel was more even handed than the original wave of the industrial revolution. The original inventions that were the basis of the industrial revolution were English creations, both steam engine development and textile manufacturing machines. The second wave of science-based innovation was far more cosmopolitan.

Hearth Regions of Innovation

The traditional tripartite division of economic activities fits all economic enterprise into the categories of production, distribution, and consumption. The activity of production occurs at a specific place, and production means adding value by combining or assembling resources (customarily denoted factors of production, such as land, labor, capital, and management or organization). In a nonexhaustive explanation both extractive industries (mining, agriculture, fishing, and forestry) and manufacturing (changing the form, both mechanically and chemically speaking, including blending of materials) are included in goods production. The salient point for this discussion is that the value is added within a region. That is, production is region-specific. The prosperity of the region largely depends on the terms of trade when the commodities produced (both goods and non-goods services) are entered into interregional trade. In a global competitive market surplus supplies from all regions help

to determine the price along with the demands for the commodity from all regions.

Hearth regions of innovation are observable phenomena. Silicon Valley is a hearth region for innovative electronic products. New York City, Miami, and Los Angeles are innovative regions in ready-to-wear clothing. The Pittsburgh-Youngstown-Cleveland corridor was an innovating region in the steel industry for most of the twentieth century. Improved coking furnaces, blast furnaces, open hearth furnaces, rolling mills, strip mills, electric furnaces, basic oxygen process equipment, stainless steel, were all developed within the region. The innovations were both step jumps and incremental improvements and early adoption allowed margins that exceeded long run competitive returns.

The ability to innovate is the basis of regional development policy for Ohio (Boskin 1986, Janson 1993). Without innovations a region is destined to be a commodity producer competing almost solely on the basis of price with producers from all over the world—producers that, in general, have substantially lower labor costs.

There have been many great bursts of creativity in production that assured preeminence to hearth regions of innovation. Part of the Neolithic agricultural revolution originated in the Middle East. Grasses were domesticated into cereal grains, and that allowed most of mankind to change from hunter-gatherer to farmer-herdsman. Other bursts of agricultural innovations, including the domestication of potatoes, corn, and tobacco, occurred in Middle America and highland areas of northern South America. Of course the transformations occurred in many regions involving diverse species of flora.

Fourteen millennia later, production of manufactured goods soared in England when steam was used to drive machinery in the first wave of the industrial revolution. Two and a half centuries after the first wave, about 1880, the second great wave of innovations transformed society. The second wave of invention and innovation was based on electrical energy (motors and generators) and the internal combustion engine. The complex of products and processes related to these fundamental sets of innovations suburbanized both industrial and residential sectors. Detroit became the hearth region of innovation for gasoline powered vehicles. Enormous wealth accrued within the innovating regions of production. A recitation of innovations and the innovating hearth regions is not appropriate for this discussion, but several examples are warranted (Utterback 1987).

Organic chemistry was brought to great commercial success in Germany near the end of the last century (synthetic dyes and aspirin, for example), and Germany is still a hearth region for advances in chemistry. Seattle, WA, because of the presence of the Boeing Corporation, and Dayton, OH, because of the presence of Wright Patterson Air Force Base, are both contemporary hearth regions for aerospace innovations. Silicon Valley, Boston, the Research Triangle, and Austin are contemporary hearth regions for innovations in electronics. Akron was an innovating region in the rubber industry early in the twentieth century and remains an innovating region in polymer research and polymer production, lineal

descendants of synthetic rubber. Columbus is a hearth region for large, complex on-line data base services. Cleveland by the 1920s was a preeminent manufacturing city, and is still an innovating region for advanced manufacturing technologies. Of course, to realize the extraordinary gains of innovation, it is necessary to market the products beyond the regional boundaries.

GLOBALIZATION PROCESSES: THE NEW REALITY

World Trading System

The contemporary pattern of world manufacturing is extremely uneven and so is the pattern of world trade, whether expressed as export flows or import flows. The great economic dominance of the United States following World War II declined relatively as Europe and Japan rebuilt after the devastation of the war, and as South Korea modernized after the Korean War. The oil shocks caused by quadrupling oil prices in 1973 by the Organization of Petroleum Exporting Countries cartel (OPEC) triggered a severe global recession that persisted for almost a decade. Unemployment in the early 1980s rose to post-war highs; factories closed in many old-line industries and communities tightly linked to the collapsing industries were devastated. Many of these agonies had other causes than the price of oil, including labor costs that were too high, work rules that were too restricting, and inflation in commodity markets. The oil price shocks initiated the restructuring of manufacturing processes. In 1989 the Soviet empire and the hegemony that accompanied the system broke into fragments along with the associated trading system of the communist states, which had been subsidized by the Soviet Union.

A macro trend of global significance was the emergence of multinational trading blocs; first, the agreement by the European Community (EC) in 1992 that eliminated tariffs among the European Community members; and second, ratification in 1993 of the North American Free Trade Agreement (NAFTA) that will gradually eliminate almost all tariffs between the three trading partners—the United States, Canada, and Mexico.

In 1994 the World Trade Organization (WTO) was created as a permanent international bureaucracy to monitor and supervise the negotiations made under the General Agreement on Tariff and Trade (GATT). The WTO treaty has not yet been ratified by the United States Congress. The debate in Congress is likely to be acrimonious, but eventual ratification is almost certain because, otherwise, the United States will be opting out of a world trading system (Financial Times 1993a).

Transnational Corporations (TNC)

The primary agent internationalizing production is the transnational corporation (TNC). Dicken (1992a), an authority on this subject, partially defines the TNC as a company that makes production location decisions that cross international boundaries. TNCs, so defined, now account for approximately one fourth of total world manufacturing production, and approximately 40% of total world trade (exports and imports). Most of this trade is between divisions or associated companies of the same

TNC. For this reason it is fair to say that foreign direct investment drives international trade.

TNCs are represented in a complete spectrum from companies with operations in two countries to global giants represented in over 20 countries. Manufacturing output is heavily weighted toward the global giants, such as Ford, Phillips, DuPont, Royal Dutch Shell, Exxon, Chrysler, General Electric, Mitsubishi, Hitachi, General Motors, Timken, Siemens, Hyundai, IBM, Toyota, Procter & Gamble, TRW, Samsung, Goldstar, and others.

The growth of TNCs was rapid in the 1960s, more than twice the rate of growth in world output during the decade; but in the 1970s the rate accelerated and was four times the rate of growth of world output. The relative share of the United States dropped as Japan, England, and West Germany increased their share. One other aspect of TNC global trade is the overwhelming percentage of world trade that transfers among the four great nation participants. TNCs from the United States, England, and West Germany made many investments in plant and equipment in each other's country, but did not invest in Japan with proportionate frequency. Japanese TNCs made direct private investments (FDI) in all three of the other important TNC nations. In addition to the three developed nations, two developing nations (Brazil and Mexico) heavily skew the location of FDI. The globalization of production is continuing among the major players, and is being expanded at an accelerating rate in the rim nations of east Asian and south Asian nations. The current rate (1992) of FDI in the developing regions of the world is between \$40 billion and \$80 billion.

Foreign Direct Investment (FDI)

Three nations alone—the United States, Japan, and united Germany—account for almost half of total output by market economies. Nearly all foreign direct investment is put in place by firms headquartered in advanced market economies (90%). Most direct foreign investment is placed in a plant in some other advanced market economy (over 60%). The remainder goes to developing regions. The Asian rim countries and Latin America get virtually all of the direct private investment that goes to developing nations. Africa receives a negligible amount (See Dicken 1992, Howes and Markusen 1993, United Nations 1993).

The value of direct investment in foreign regions by transnational corporations is now on the order of \$200 billion per year. The annual growth rate has been about 13% over a 20 year period. This is startling evidence of the new regime in nation state relations. National boundaries are of diminishing importance in decisions relating to production locations. A hostile attitude toward multinational companies that prevailed in many nations during the 1960s has almost disappeared. Even idiosyncratic India now welcomes foreign investment along with the jobs and incomes that accompany foreign direct investment. The results are highly uneven, and the reasons for the unevenness will be plumbed.

United Nations data (United Nations 1993) indicate that approximately 37,000 corporations (TNCs) have more than 170,000 foreign affiliated operations (60% manufacturing, 37% services, and 3% in primary activities

such as agriculture and mining activities). Tony Jackson of *Financial Times* summarized the UN data. The worldwide total foreign direct investment (FDI) is now \$2 trillion dollars. The United States share is about \$1/2 trillion; the United Kingdom share is about \$1/4 trillion; and the Japanese share is also about \$1/4 trillion. TNC sales outside their home countries are now \$5.5 trillion, and the total value of world exports is about \$4 trillion.

Location based on comparative advantage is still relevant. A single plant establishment may ship product to company-owned and other customer plants worldwide. According to Dicken (1992), the decision to locate in a particular place requires as necessary conditions: 1) a skilled or educated workforce; 2) an existing infrastructure of communications and transportation, including roads and airports; and 3) a welcoming attitude by officials and people of the host region. If these necessary (but not sufficient) conditions are fulfilled the global site decision can be largely based on lowest direct cost analysis.

A clear distinction between foreign direct investment (FDI) and portfolio investment (PI) is important. FDI means real investment in plant and equipment with some powers of corporate control. This is the investment that corresponds to globalization of production. Portfolio investment is simply purchase of securities for the purpose of earning dividends or capital gains and is not relevant in the context of this discussion.

The three conditions for site location indicated earlier are met in the developing rim nations of East, Southeast, and South Asia, as well as Latin America and the Caribbean.

Adaptations by Transnational Corporations

The response to globalization processes by transnational companies is both industry specific, country specific, and firm specific. The industry constraints reflect the reality of the global markets and the firm constraints reflect the organization of the firms operating within the legal, social, cultural milieu of the host nation. Several examples of corporate adaptation will illuminate the matter (Business Week 1994).

ABB (Asea-Brown Bovari Ltd.), the major producer of electric generating equipment in Europe (annual sales over \$30 billion) faces emerging markets in eastern Europe and even greater opportunities in eastern and southeastern Asia, and a potentially enormous market in China. The realities of the close communication with governments necessary for the sale of major electric generating equipment requires resident national companies, which may be wholly or partially owned by ABB (headquartered in Switzerland). The result is a devolvement of responsibility to the subsidiaries and a headquarters staff that is less than 200. ABB headquarters manages the subsidiaries as both a TNC and as a portfolio investor. Of course, there are great advantages of mutual benefit among the national companies. About half of all international trade is between intrafirm companies. Subsidiaries of ABB specialize in heat exchangers, dynamos, boilers, tubing, motors, transformers, transmission equipment, and other related equipment. The global organization of the firm facilitates intra-company sales among the international units. Nevertheless, the relationship with

government itself is often the key to unlocking the emerging markets, because policy, planning, and government involvement are prerequisites to expansion of the electricity grid. Credits from the Export-Import Bank, arrangements with the World Bank, and agreements with the International Monetary Fund all have bearing on multibillion dollar investment strategies by the developing nation states (Barnevik 1994).

Ford's globalization reorganization is designed to achieve international economies by specialization. For example, all small car design and development will soon be performed by European engineering groups, which are most expert in this specialty. Truck and van design and development will occur in the United States, where personnel are most expert in this other specialty. Product development, sales, and manufacturing of operations currently organized separately in North America, Europe, Latin America, and Asia will ultimately be merged into one organization. Savings could be on the order of \$3 billion annually. The Ford TNC response to globalization realities cuts out layers of management and illustrates a flattened horizontal organization that is possible, providing the product is actually a global product.

Sony has worldwide brand name product groups but still maintains four geographic zones for management of global operations. Bristol-Myers Squibb has also created a single worldwide unit responsible for Clairol and hair-care products, because Clairol is a global consumer product with brand name asset value. IBM is reorganizing into 14 worldwide industry groups in order to interface with customers in a more responsive way and to eliminate the geographically based turf wars in their own organization (Business Week 1994).

General Motors Packard Electric Division (Warren, OH) manufactures wiring harnesses for GM cars. Many of the terminal components are manufactured in Warren, OH, and in other plants in the United States. Frequently, these subassemblies are complex and require sophistication in manufacture and assembly. These components are collected into kits and shipped to GM plants in Mexico where the final assembly is made manually and the finished wiring harnesses are then shipped to GM assembly plants and to other customers anywhere in the world. This is the reality of the new regime in international trade.

New Division of Labor

Geographers and economists have designated the realignment of producing regions as the new division of labor. One of many observations is that some mass produced products, especially those requiring low skills, are now being produced off-shore, often from satellites of TNCs. Asian rim countries and Mexico are favored regions by United States based TNCs for production using low cost labor. This connects the Asian producer nations to the great United States consumer market. In Europe most of the production remains within the European Community (EC). Italy and Spain are the most important regions for similar production utilizing low cost labor.

The processes of the division of labor are continuous. Japanese manufacturers moved production to Taiwan years ago, and Taiwan manufacturers are moving production

to Thailand and other Asian nations in the continuing effort to lower production costs. This cascading effect reflects rising wage levels as economies advance and the consequent shift of production to off-shore regions with lower labor costs.

A note of caution is appropriate. About 25% of the world's population lives in advanced market economies (money exchange economies). The remainder of the world is still rural. Many rural regions have economies dependent on barter to a large degree and based on subsistence farming, sometimes feudal, and sometimes tribal. The comments and observations in this paper refer primarily to the rich one-fourth of world populations. Even within this one-fourth the levels of activity are greatly unequal.

The gross domestic product of one nation in Africa, South Africa, exceeds the combined gross domestic product of all other nations in Africa. The poor nations of the world aspire to be included in the new regime and the circle of participation is widening, even as income disparities widen.

Container Shipping

Distribution, like production, has had historical periods with great innovative bursts that yielded large returns to the innovating regions. Interregional trade, both domestic and international, is the essential purpose of distribution in order to realize gains from efficient production. Transportation and communication are aspects of distribution that facilitate interregional trade. Innovations that reduce costs of transport, communication, and warehousing, and innovations that widen markets also contribute. Innovations in transport technologies often drive interregional trade in the quest for wider markets.

With the introduction of modern container ports a tremendous shift in the hierarchy of U.S. ports was inevitable. The finger docks of San Francisco and New York City were inadequate to the imperatives of the new paradigm. Twenty or thirty acres of land are now required for a container ship berthing area, and 100 or 200 acres are needed for railroad sidings and semi-trailer parking. Tens of thousands of longshoremen are gone from the docks of San Francisco and New York. Container facilities shifted port activities across San Francisco Bay to Oakland, and across the Hudson River to Elizabeth, NJ. Only a small fraction of the personnel required in the old days, when ships were hand loaded, are now needed. Tremendous capital investment has caused redundancy in the work force. Multimillion dollar cranes controlled by skilled operators have replaced whole gangs of hard working longshoremen.

Container ships are as long as aircraft carriers and a technical principle of naval architecture implies that these very large ships will also be very fast ships. Less energy is dissipated in nonfunctional pitching in the restless sea. The great, fast container fleet has replaced squadrons of general cargo ships. The world's goods move increasingly in containers, and the great ships of the global container fleet can be unloaded and reloaded in a day or two instead of six days characteristic of the older mode dependent on human labor. The breakdown of the

shipment occurs at the customer's plant instead of on the dock, and the plant may be located thousands of miles from the waterfront. Transport costs have dropped; productivity by ocean transport has sky rocketed; and theft is negligible. In the old days it was not uncommon for one-fourth of the merchandise (by value) to be stolen between the exporter's loading dock and the importer's receiving dock.

Investment in container ports coincides with a shift in world trading patterns. More imports now enter the United States from the Pacific Ocean than from the Atlantic. Seattle and Tacoma (combined) and Los Angeles are gateways to United States markets from Asian points of origin. Together these two gateways receive about 45% of all United States imports. Moreover, 70% of the containers coming into Seattle are immediately put on unit trains of flat cars and the containers are taken to some other domestic destination, sometimes to an east coast or Gulf coast port for transshipment by container ship to Europe. The reason for the change in modes of transport is based on simple direct costs. It is now cheaper to use a rail link across the United States, even when containers from Asia are destined for Europe.

INTELLECTUAL PROPERTY RIGHTS: MUTUAL BENEFITS

The gains of international trade are not simply the gains that result from comparative advantage based on resource endowments. Of course Ohio and Florida can mutually gain by respective specialization in stainless steel and oranges. There is a profound implication that goes far beyond this obvious example.

The stock of many listed firms trades at 2- or 3-times book value. The difference may be called goodwill on a financial statement, but it is a measure of intellectual property—the value of patents, brand names, research in progress, and the skills and talents of its people (Financial Times 1993b).

For over two decades manufacturing jobs have been falling in a secular trend in all of the major industrial nations of the world. This reflects automation in the factory and also the shift of employment from manufacturing to services. In the United States the proportion of the work force in manufacturing is about 15% even though it is still about 32% in Germany. The competitive drive for low cost production will push these percentages lower, perhaps as low as 10% within 30 years (Financial Times 1993c). These job losses imply improvements in productivity caused largely by technology changes in process (know-how), which is another form of intellectual property. Frequently process changes are incremental and are protected only as trade secrets. Nevertheless, continuing incremental improvement in process can result in multimillion dollar savings in mass production industries.

Pharmaceuticals provide many examples of intellectual property with high values. One example from the pharmaceutical industry will suggest the significance of intellectual property rights to TNCs. Glaxo, based in the United Kingdom, is the patent holder of Zantac, the largest selling drug in the world. Glaxo sells about \$3.5 billion worth of Zantac per year for ulcer treatments. A recent

article in *Financial Times* indicates that a \$700,000,000 loss of sales per year would result if claims to a generic version by a competitor (Novopharm of Canada) were recognized by the courts as not infringing the Glaxo patent.

Software Patents

Before 1986 software patents were not granted in the United States. Since then about 10,000 software patents have been granted and 15,000 applications, more or less, are waiting for patent determination. This area of intellectual property is likely to become a mine field of litigation. Compton's New Media has produced a multimedia encyclopedia, and has obtained a basic patent on retrieving text, images, audio, and video from a database. A group of intellectual firms—Apple, IBM, Digital Equipment, Lotus, and Microsoft—have formed the Software Patent Institute to build a database of patents for the Patent Office in order to reduce patent litigation (*Financial Times* 1993d).

At present in the United States patents are kept secret until issued. Many firms in the electronic industries want the law changed to allow competitors the opportunity to challenge patents before they are issued. The liability incurred by infringing a patent is triple damages, and ordinary business decisions quickly become a high stakes game.

Trade Agreements

The General Agreement on Tariffs and Trade (GATT) establishes rules for fair and free managed trade among the nations of the world. The most significant new arrangements include a lessening of tariffs on manufactured goods (about 40%) and on agricultural products, and extends rule based trade to the service sectors by providing strong protection for intellectual property rights. The protection of intellectual rights insisted upon by the United States was largely accepted by developing nations. At the same time, the United States insisted on the reduction of agricultural tariffs, which will allow greater opportunity for less developed nations to earn hard currencies by pursuing comparative advantage in agriculture. Most large corporations are not willing to put plants in foreign countries unless intellectual property rights are protected. There is now a mechanism to provide this protection (*Financial Times* 1993e).

Corporate Strategy

Corporate strategy can take diametrically opposite positions with respect to intellectual property. For example, IBM personal computers were designed with open architecture using an Intel chip processor and a Microsoft DOS operating system. The objective was to widen the use of IBM equipment by making it easier for peripheral manufacturers and software companies to produce compatible equipment. The strategy also spawned cloned PCs from competitors such as Compaq and Dell. On the other hand, Apple has consistently used proprietary circuits manufactured by Motorola with a proprietary operating system. This closed architecture has been combined with aggressive patent enforcement of their intellectual property.

The acrimonious litigation over intellectual property between Intel and AMD (Advanced Micro Devices) is continuing and goes back to an agreement in the '70s still under dispute. AMD claims that the right to clone the Intel 386 and 486 chips was conveyed in an early licensing agreement, whereas Intel claims the opposite. Meanwhile both companies have prospered, with Intel now the largest chip maker in the world. AMD's stock was adversely effected when a court awarded more than a billion dollars to Intel, ruling that patent infringement had occurred. This ruling is devastating, because the enormous award represents triple damages. Of course appeals are still going on and both firms are producing chips at flat-out rates.

To avoid the development of intellectual property that is of little value there is a necessity for specification of industry standards (protocols) and manufacturing standards: Protocols are of vital significance to those industries where equipment produced by sets of manufacturers must all interface. The European Union has established the Digital Video Broadcasting Group (DVBG) that unites about 120 manufacturers, satellite operators, governments, broadcasters, and others to establish common European standards that allow for transmission and pay-TV decoding. Clearly a single decoder in a household is preferable to many decoders, especially if programs from many suppliers can be actuated with a debit (smart) card. Without common standards, much intellectual property under development will not have wide markets. Examples of protocols that accelerated network expansion are Token Ring for IBM equipment interfaces and Ethernet for ATT telephone switching equipment interfaces.

Even middle-size electronic corporations (500-3,000 employees) in the Silicon Valley environment are likely to have several lawyers on staff to protect the intellectual property of the corporation on a timely, day-to-day basis.

Global Trends in Intellectual Property

The general concept of encouraging foreign investment is now widely accepted by developing countries as their road to national wealth. The trading nations have linked foreign investment to intellectual rights in the GATT agreements. All types of intellectual property have now come under an international treaty and this allows consistency and enforcement. Enforcement will be made through the World Trade Organization (WTO) a new international bureaucracy established by the treaty. A summary of the major agreements effecting intellectual property is the following:

1. Patents are protected for 20 years within the national boundaries of all signatory nations. Patents on life forms were excluded.
2. Copyrights are valid for 50 years and software programs and data compilations may be copyrighted. The owners of the copyright have almost exclusive rights to rent or lease the product. Sound recordings and broadcast recordings share the same protection with performers and producers and have similar rental rights.

3. Trademarks and geographic indicators, important in such industries as wine production, are now protected.
4. Layouts of circuit design for micro-devices are protected for 10 years.
5. Trade secrets are protected from disclosure.

These agreements are of vital and far-reaching effect. According to Frances Williams of *The Financial Times* the principle involved is equal treatment for foreign rights holders and domestic rights holders in all regions. The idea is to eliminate discrimination between trading competitors regardless of the manufacturing region and regardless of the market region.

New patents being filed in the United States in 1992 underline the emergence of Japan as a leader in this aspect of intellectual property. In a recent year Japan made approximately 200,000 filings versus 60,000 for the United States and less than that by other leading industrial nations. Research centers, such as Fraunhofer institutes in Germany and Edison Centers in Ohio, develop subsidized research that can be purchased by private firms. Often the firm has participated in a jointly funded research project culminating in patent applications. From a regional development perspective the question is whether more money is paid out to foreign owners of intellectual property than is earned from foreigners for intellectual property.

Globalization Effects on Small Firms

As the barriers to entry into foreign markets come down, as intellectual property is more securely protected, as tariffs are lowered, as distribution technologies become more efficient, as consumer tastes around the world converge, as money capital markets become more transparent, as expert computer programs proliferate—in short, as the processes of globalism proceed—smaller firms, not larger ones, are enabled to compete in international markets, even more effectively than their giant competitors with their contingent overheads. This is true for most manufacturing industries, a statement that appears to contradict the American experience in an historical framework (Felix 1977, Economist 1993).

Institutions such as the Technology Centers of The Thomas Edison Program of the State of Ohio now offer guidance in technology development and technology deployment that facilitates the transfer of technology to small firms in order to change their current production practices to state-of-art production. Small firms now have access to software production programs and financial programs that are equal to the learned behavior of the giants over many decades. These programs are a distillation of learned behavior. This is of significant consequence. Approximately 1,000 firms are members or users of Edison technology centers and these 1,000 firms account for approximately half of the value added by manufacturing in Ohio. All of the member firms, as well as participating non-member firms, have been impacted at least marginally by Edison initiatives using shared intellectual property to increase innovation by Ohio manufacturing firms.

CONCLUSION: TRADE, THE ADJUNCT TO INNOVATION

Emerging Global Patterns of Production and Trade

Globalization processes now underway, spear-headed by transnational corporations, are as radical and challenging as the establishment of protocols for trade among aboriginal mortal enemies, the rise of commercial towns in medieval times, the settlement of trading enclaves on remote foreign coasts during the Age of Discovery, the linking of colonial plantation regimes to the mother country during the Age of Imperialism, and the emergence of trading blocs of continental proportion since World War II. All of the stages in the historical development of geographic patterns of production and trade were interactive with the political structure and the technological development of the corresponding era. Contemporary globalization processes have similar far-reaching and profound effects.

The new world order that is emerging will bind the world's regions into patterns of production and trade that will transcend previous patterns based on military conquests and political hegemony. The changes are fundamental and irreversible. The newly formed World Trade Organization (WTO) will have more than 150 signatory nations. Regions all over the world will be able to compete on an equal basis. Foreign firms resident in any region will have nearly the same corporate and commercial rights within the region as a local firm. Gains to people everywhere in the global system will result from more efficient production, because the gains diffuse through interregional trade in a competitive environment. At the global scale welfare of people will clearly be enhanced through the quasi-income effect of lower prices. At the regional level welfare depends on the efficiency and effectiveness of the region's establishments. Those manufacturing and service firms that are innovative, aggressive, and capable, measured by world standards, will prosper. The remainder will face bankruptcies and involuntary down-sizing, with associated job losses, assaults to personal dignity and status, and devastation of entire communities.

The function of government is to manage change—the business of politics. Interregional trade is the adjunct of innovation, the bedrock of Ohio development policy. Trade policy initiatives of the Ohio Department of Development are now proactively addressing the globalization processes of tidal proportions. Regions that cannot match the courage displayed by Ohio's bipartisan political leadership will be overwhelmed.

Innovation, by its nature, is creative destruction. Productivity of the individual worker increases as a result of investment in plant and equipment that provides more cost effective methods of manufacture. Automation usually maintains the values added by manufacture as the workforce downsizes. Expanding the workforce under the new conditions requires expanding the markets. The corollary to regional development policy squarely based on innovation is sustained marketing policies to expand exports out of the region. For this reason the Department of Development of Ohio has a continuing presence in foreign cities. At the same time other export enhancing

initiatives are pursued by the Department, including tax credits for job creation, export tax credits, access to information services, trade show exhibitions, incentives for research and development, and a set of financial incentives, including a direct loan program (enterprise bond fund financing), and enterprise zone incentives, as well as technical assistance through the Thomas Edison Program.

Implications for Ohio Development Policy

The most vital contemporary agency of change in the emerging global economy is the transnational corporation. The manufacturing and market decisions of these firms profoundly effect the destiny of regions around the world. The intricate articulation of production among divisions of a TNC assures that in nearly all cases the plant production is for a wider market than the host region. In many cases production is for a global market. More than 50% of foreign trade (the sum of exports and imports) for both the United States and Japan now consists of shipments between plants of transnational corporations.

The total number of worldwide manufacturing firms that have sales over one billion dollars annually and have production facilities in two or more nations is about 1,000. Less than 100 manufacturing firms meeting this definition of a TNC currently have at least one production facility in Ohio. This Ohio base for manufacturing production is sound and growing, but is much too small to assure high levels of opportunity and prosperity for our work force in the early decades of the next century.

Value added by manufacturing for the United States economy is about 24% of the world total, which includes all advanced market economies, all developing market economies, and all command economies (particularly China). Ohio value added by manufacturing is about 6 or 7% of the United States total, and Ohio value added by manufacturing is thus about 1.5% of the world total. It is manifestly urgent for Ohio to maintain and increase its share of value added by manufacturing.

Ohio development policy already reaches out around the world to attract foreign TNC investment for production facilities in Ohio. Initiatives to make Ohio attractive to foreign investment are necessary conditions in a competitive environment. Policies friendly to foreign direct investment are required in all aspects of regulation and governance including environmental mandates, worker's compensation insurance, access to public procurement, protection of intellectual rights, full involvement in Thomas Edison Technology Center activities, voice in legislative hearings, access to elected officials, and all other privileges that appertain to resident Ohio based corporations. Recruitment of foreign manufacturers should have a global perspective with emphasis on Canadian, Japanese, German, British, French, and other European corporations along with Mexican, Brazilian, and Argentinean corporations.

The reorientation of global manufacturing is a continuous evolutionary process. Proximity to raw materials is of lesser importance than in the past because of gigantic increases in productivity in transport and distribution activities. Manufacturing plants in the future will be more directly oriented on the basis of information, especially

information on markets, and whenever the product gains bulk in assembly. This reorientation has already occurred in automobile and truck assembly plant locations. The concentration has been along a band of states from Michigan, Ohio, and Indiana to Texas. The expansions of the European automotive firms in South Carolina also moved production facilities toward markets. These are reorientations based on contemporary technologies. From Ohio's perspective the nationality of ownership should be almost an irrelevancy. We should expect good corporate citizenship, welcome and inform foreign owners, and treat branch plants of foreign companies with impartial equality with indigenous manufacturers.

Increased job opportunities for Ohio citizens is the most important benefit of a global manufacturing policy for Ohio. The benefits to Ohio government are as obvious as the benefits to the labor force. Ohio income taxes, both corporate and individual, will be enhanced at all levels of government. Revenue sources will increase from real estate taxes, both from plant and equipment investment by the corporations and from housing investment by the workforce. Shopping centers and retail investment by builders and developers will follow promptly and sometimes will lead the growth curve. Sales tax revenues will correspond. The horizon of job opportunities for Ohio workers will expand along with the globalization processes now underway. There is no longer any viable option for an iconoclastic policy that attempts to shield Ohio manufacturers from the winds of change in global trade—winds of historic proportion.

Exports already account for more than 12% of U.S. outputs; and imports account for more than 15% of inputs.

The Challenge for Ohio

Real income is created in the region where value is added in the production process. This fact is a substratum that underlies the logic of regional science. A simple theorem proves the equality of the aggregate value added in the region and gross regional product of the region. Net real regional income and net regional product are also equivalent and are values obtained after subtracting for depreciation. One obvious measure of the prosperity of citizens of the region is the measure of net real income per capita. Other rough measures of prosperity are also appropriate in the context of development policy for Ohio.

About 1.5% (0.015) of world economic output is produced in Ohio, but Ohio has only one five-hundredth (0.002) of the world's population. Per capita output from Ohio's factories, farms, and mines, and from our service organizations is about 7 1/2 times the per capita value for the world. This is a metric for measuring the current prosperity of Ohio by world standards and a metric to measure the challenge to maintain Ohio real income per capita (standard of living).

In the world of competitive reality technologies are not constant nor are the other conditions of production. Plants will move and firms will invest in foreign regions to enter markets that are closed, or to gain access to better technology, or to be closer to their markets, or to provide a link in their worldwide production network.

Reconfigurations of plants, products, and markets are continuous processes. The internal structure of the TNC reduces costs (Financial Times 1993c). Branch factories of the TNCs are the plants Ohio needs regardless of the country of ownership. Output from these plants will vastly exceed Ohio needs and shipments will be made to the rest of the United States and to the world beyond, frequently to other plants owned or controlled by the same TNC. This is an advantage to Ohio because on average approximately 50% of TNC manufacturing output is sold to sister companies. The stability created by semi-assured sales is highly desirable.

Most off-shore investment by firms headquartered in advanced market economies is in other advanced market economies. The remarkably rapid growth of direct foreign investment (FDI) in the Pacific Rim countries is dwarfed in absolute terms by investments in advanced market economies. The most likely firms to invest in green field plants in Ohio are firms from Canada, Japan, Germany, the United Kingdom, France, and several other European nations. TNCs already have global production networks that depend on international sales. Innovation is the prime mover of efficient production (both goods and services) in a dynamic, expanding economy that offers jobs to citizens and competitive products to customers. Trade is the adjunct to innovation. Output has to be sold for incomes to be realized. The transnational corporation already has a global network in existence for the purpose of increasing worldwide sales.

Transnational manufacturing corporations are the contemporary equivalent of the great trading companies in earlier times. Remember the Portuguese mariners sailing to the Spice Islands (Moluccans, southeast of the Philippines), south India, Ceylon, and the Malaysian archipelago in the 1500s; or the traders from Amsterdam working for the Dutch East India Company in Batavia (Java 1619 to 1811). Recall the French fur traders from the Company of One Hundred Associates (1627-1663) gliding by canoe through the North Woods 1,000 miles from Montreal, bartering with the Indians for beaver pelts. Picture the Scotch factors, the buffalo hunters, and the voyageurs at Selkirk on the Red River or at Fort Edmon-ton on the Saskatchewan River at Hudson's Bay Company forts (1670-1869); and the young English clerks toiling for the East India Company during the century after 1641, at their major trading station on the Coromandel coast (Madras, India). The technical person sitting beside you on an international flight, the seasoned engineer in the row behind, and the female industrial engineer traveling to implement a manufacturing software program in a foreign plant are contemporary counterparts.

In a long term analysis that assumes, artificially, that no new technologies will be developed, a gradual shift to low cost production will reconfigure the economic-geographic landscape. For some products this will entail off-shore plants in low wage regions. For other products

lowest cost production will imply massive investment and automated factories in high wage regions.

The concept (definition) of value added stripped to the barest essential is the difference between sales and the cost of goods and services required for production. This difference (value added in the region) includes both payroll and profit. Payroll is the reason for the focus on jobs by the Ohio Department of Development. Profit is the focus of firms employing Ohio citizens. Both jobs and profits are simultaneously determined. In an ideal world, taxes should come out of earnings. Incentives to trans-national corporations to invest in plant expansions and to locate greenfield factories in Ohio must be realistic and sincere. Prosperity for Ohio will follow.

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